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ANNOTATED LIST OF ELM INSECTS IN THE UNITED STATES

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CONTENTS

	Page		Page
Introduction.....	2	Coleoptera—Continued.....	
Collembola.....	3	Endomychidae.....	9
Entomobryidae.....	3	Tenebrionidae.....	9
Orthoptera.....	3	Melandryidae.....	9
Blattidae.....	3	Anobiidae.....	9
Gryllidae.....	3	Bostrichidae.....	9
Isoptera.....	3	Cisidae.....	10
Termitidae.....	3	Scarabaeidae.....	10
Plecoptera.....	3	Lucanidae.....	10
Nemouridae.....	3	Passalidae.....	10
Corrodentia.....	3	Cerambycidae.....	10
Psocidae.....	3	Chrysomelidae.....	11
Perientomidae.....	3	Brentidae.....	12
Thysanoptera.....	4	Anthrribidae.....	12
Thripidae.....	4	Curculionidae.....	12
Merothripidae.....	4	Scolytidae.....	12
Phlaeothripidae.....	4	Lepidoptera.....	13
Hemiptera.....	4	Incurvariidae.....	13
Aradidae.....	4	Nepticulidae.....	13
Piesmididae.....	4	Megalopygidae.....	13
Tingitidae.....	4	Limacodidae.....	13
Nabidae.....	4	Tineidae.....	13
Anthocoridae.....	4	Psychidae.....	13
Miridae.....	4	Lyronetidae.....	13
Homoptera.....	5	Gracilariidae.....	13
Cicadidae.....	5	Coleophoridae.....	14
Membracidae.....	5	Oecophoridae.....	14
Cicadellidae.....	5	Gelechiidae.....	14
Fulgoridae.....	5	Cosmopterygidae.....	14
Aphididae.....	5	Yponomeutidae.....	14
Aleyrodidae.....	5	Scythrididae.....	14
Coccidae.....	6	Olethreutidae.....	14
Coleoptera.....	6	Tortricidae.....	14
Carabidae.....	6	Cossidae.....	14
Orthoperidae.....	6	Epipaschiidae.....	14
Staphylinidae.....	6	Phycitidae.....	14
Histeridae.....	7	Citheronidae.....	14
Malachidae.....	7	Saturniidae.....	14
Cleridae.....	7	Lasiocampidae.....	15
Mordellidae.....	7	Drepanidae.....	15
Pyrochroidae.....	7	Geometridae.....	15
Elateridae.....	7	Sphingidae.....	15
Melasiidae.....	8	Notodontidae.....	15
Buprestidae.....	8	Liparidae.....	15
Rhyssodidae.....	8	Phalaenidae.....	15
Ostomidae.....	8	Arctiidae.....	16
Nitidulidae.....	8	Nymphalidae.....	16
Cucujidae.....	8	Diptera.....	16
Erotylidae.....	8	Anisopodidae.....	16
Mycetophagidae.....	9	Tipulidae.....	16
Colydiidae.....	9	Psychodidae.....	16

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Diptera—Continued.	Page	Hymenoptera—Continued.	Page
Ceratopogonidae.....	16	Siricidae.....	18
Cecidomyiidae.....	16	Cimbicidae.....	18
Mycetophilidae.....	16	Argidae.....	18
Sciaridae.....	16	Tenthredinidae.....	18
Rhagionidae.....	17	Braconidae.....	18
Stratiomyidae.....	17	Ichneumonidae.....	19
Asilidae.....	17	Cynipidae.....	19
Dolichopodidae.....	17	Chalcididae.....	19
Phoridae.....	17	Eurytomidae.....	19
Syrphidae.....	17	Encyrtidae.....	19
Anthomyiidae.....	17	Clasomyidae.....	19
Lonchaeidae.....	17	Pteromalidae.....	20
Otitidae.....	17	Eulophidae.....	20
Chloropidae.....	17	Mymaridae.....	20
Drosophilidae.....	17	Chrysididae.....	20
Agromyzidae.....	17	Formicidae.....	20
Hymenoptera.....	17	Sphacidae.....	20
Xyelidae.....	17	Halictidae.....	20
Xiphydriidae.....	18	Megachilidae.....	20

INTRODUCTION

Since the discovery of the Dutch elm disease fungus (*Ceratostomella ulmi* Buisman) in the United States in 1930, many entomologists and pathologists have become interested in the variety of insects found in elm material because of their possible relationship to the dissemination of the fungus. The smaller European elm bark beetle (*Scolytus multistriatus* (Marsh.)) and the native elm bark beetle (*Hylurgopinus rufipes* (Eich.)) are proved inoculative agents of the fungus. Under controlled conditions another bark beetle, *Scolytus sulcatus* (F.), and the elm borer (*Saperda tridentata* Oliv.) have been effective as agents of inoculation of the Dutch elm disease fungus. Research workers are conducting transmission experiments with other elm insects suspected of being vectors. Most of this work appears to be directed toward the determination of primary insect carriers—those species capable of inoculating a healthy tree with the fungus. Another phase of transmission research concerns the role played by secondary insect carriers of the fungus—those species capable of spreading the fungus from gallery to gallery in devitalized elm trees, felled trees, and logs. When the fungus occurs in insect-infested trees or logs, it frequently produces coremia in the galleries. Insects coming in contact with the coremia heads are believed to become contaminated with the fungus and perhaps spread it to other galleries or even to create an additional reservoir in other insect-infested elm material heretofore free of the pathogen. Another disease of elm being studied in this country is the so-called phloem necrosis of elm, said to be caused by a virus, which may possibly be insect transmitted. It is hoped that workers concerned with these and other diseases of the elm that are likely to be insect borne will find this list of elm insects and brief biological notes helpful in selecting certain species for study. Moreover, some of the data presented should be of general interest to entomologists, foresters, and arborists.

The list is based on records found in various files of the Bureau of Entomology and Plant Quarantine and those gleaned from available entomological literature. For the sake of brevity, literature citations have been omitted, but they are available in a card catalog of the Division of Forest Insect Investigations. Only those species thought to be intimately associated with elm through breeding, feeding, ovipositing, or hibernating have been included. The inclusion or ex-

clusion of many species was largely a matter of personal judgment because of the different interpretations of what constitutes a host plant. Therefore, some species that were included perhaps should have been excluded and vice versa.

COLLEMBOLA

ENTOMOBRYIDAE

Entomobrya spp. Emerged from elm cut 14 to 16 months previously.

ORTHOPTERA

BLATTIDAE

Parcoblatta pennsylvanica (Deg.). Taken from dead standing trunk.

GRYLLIDAE

Oecanthus niveus Deg. Eggs deposited singly in the bark of the trunk and the larger branches.

Oecanthus nigricornis Walk. Eggs laid in compact long rows in the twigs.

Anaxipha exigua (Say). Eggs inserted singly, sometimes in groups, but never in rows, in the bark of the upper parts of trees ranging from 4 to 10 inches d. b. h. and in the bark of elm sprout growth. Sometimes one end of the egg reaches the sapwood.

Harpitus agitator Uhl. Eggs deposited in the corky bark.

ISOPTERA

TERMITIDAE

Reticulitermes flavipes (Kollar). Makes tunnels in the solid wood of dead and dying trees; also found in old stumps.

Reticulitermes tibialis Banks. Reported as girdling the roots of young trees.

PLECOPTERA

NEMOURIDAE

Taeniopteryx pacifica Banks. Feeds on the foliage.

CORRODENTIA

PSOCIDAE

Psocus bisignatus Banks. Reared.

Psocus inornatus Aaron. Emerged from elm cut 16 months before.

Psocus lithinus Chap. Emerged from elm cut 40 months before.

Psocus moestus Hagen. Reared.

Psocus sp., near *quacsitus* Chap. Adults issued from elm cut 15 to 24 months previously.

Psocus quietus Hagen. Reared from elm cut 38 months before.

Psocus slossonae Banks. Reared.

Psocus venosus Burm. Reared.

Peripsocus madidus Hagen. Reared.

PERIENTOMIDAE

Echnepteryx hageni (Pack.). Issued from elm cut 16 months previously.

THYSANOPTERA

THRIPIDAE

Sericothrips variabilis (Beach). Elm one of the recorded host plants.

MEROTHRIPIDAE

Merothrips morgani Hood. Under bark of fallen tree.

PHLAEOTHRIPIDAE

Hoplothrips flavipes Bagn. Issued from elm cut 7 months earlier.

Trichothrips flavicauda Morgan. Under bark.

Hoplandrothrips uzeli (Hinds). Elm a recorded host plant.

HEMIPTERA

ARADIDAE

Aradus cinnamomeus Panz. Issued from elm cut 37 months before.

Neuroclenus simplex (Uhl.). Under bark.

PIESMIDAE

Piesma cinerea (Say). Issued from elm cut 13 months previously.

TINGITIDAE

The species listed under this family suck the sap from elm leaves.

Corythucha ciliata (Say).

Corythucha ulmi O. and D.

Corythucha pergandei Heid.

Corythucha heidemanii Drake.

Corythucha pallida ulmi O. and D.

NABIDAE

Nabis annulatus Reut. This predator issued from elm cut 14 months previously.

ANTHOCORIDAE

Lasiochilus fuscus Reut. This predator issued from elm cut 40 months earlier.

Xylocoris cursitans (Fall.). This predator issued from elm cut 13 months before.

Orius insidiosus (Say). A predator found under the bark of dead elm.

MIRIDAE

Fulvius imbecilis (Say). Found beneath the bark of a dead elm.

Lopidea heidemannii Knight. Breeds on elm.

Lopidea salicis Knight. The taking of a teneral specimen that was still unable to fly indicates that this species develops on elm.

Lygus invitus (Say). Prefers young, thrifty plants with succulent shoots for breeding. Eggs inserted in the twigs.

Phytocoris cortilectus Knight. Adults concealed in crevices of the bark on the trunks.

HOMOPTERA

CICADIDAE

- Tibicen dorsata* (Say). Observed ovipositing.
Tibicen pruinosa (Say). Oviposits in both green and dead tissue.
Tibicen pruinosa (Say) var. *fulva* Beamer. One female observed while making several punctures in the heavy bark of a green elm limb about 4 inches in diameter. Also lays eggs in dead tissue.
Magicalcica septendecim (L.). Eggs laid in green twigs.

MEMBRACIDAE

- Ceresa bubalus* (F.). Eggs inserted in crescent-shaped slits in twigs 2 or 3 years old.

CICADELLIDAE

- Empoasca bipunctata* (Oshanin). This European species apparently has been taken only on elm in the United States.
Empoasca fabae (Harr.). Reared from elm.
Erythroneura basilaris (Say). Found breeding on elm.
Erythroneura kansana Bak. Apparently taken only on elm in this country.
Erythroneura maculata (Gill.). Found breeding on elm.
Typhlocyba ulmi (L.). Responsible for considerable spotting of leaves.
Typhlocyba rosae (L.). Nymphs and adults feed largely on under sides of leaves.

FULGORIDAE

- Acanalonia conica* (Say). Eggs deposited in small dead elm twigs.
Ormenis pruinosa (Say). Lives on elm and probably oviposits in elm twigs.
Ormenis septentrionalis (Spin.). Eggs laid in a shallow groove in live elm twigs.

APHIDAE

- Longistigma caryae* (Harr.). Usually found on the bark of twigs, branches, and trunks of small trees.
Myzocallis ulmifolii (Mon.). Occurs on the under sides of leaves. May cause foliage to drop prematurely.
Macrosiphum solanifolii (Ashm.). Elm a recorded food plant of this species.
Myzus solani Kalt. Elm a recorded food plant of this species.
Colopha ulmicola (Fitch). Forms cockscomblike galls on the leaves.
Eriosoma lanigerum (Hausm.) Leaves curled into terminal rosette.
Eriosoma americanum (Riley). Rolls or curls the leaves.
Eriosoma crataegi (Oestlund). Causes a leaf-curl cluster.
Eriosoma mimica Hottes and Frison. Believed to cause a curling of the leaves.
Eriosoma lanuginosum (Hartig). Produces large bonnetlike or cockscomblike galls on the leaves.
Eriosoma rileyi Thos. Forms knotty growths on trunks, limbs, and twigs of elm trees, confining its attacks to the bark.
Eriosoma ulmi (L.). Leaves curled or otherwise deformed by the leaf-inhabiting generations.
Georgiaphis gillettei (Maxson and Hottes). Elm a recorded food plant.
Georgiaphis ulmi (Wilson). Produces leaf curl.
Gobaishia ulmi-fusus (Walsh and Riley). Large, conspicuous, baglike hollow gall found on upper side of leaf.
Tetraneura graminis Mon. Forms cockscomblike galls on upper surfaces of leaves.
Tetraneura ulmisacculi Patch. Forms bladderlike galls on upper sides of leaves.

ALEYRODIDAE

- Aleyrodes essigi* Penny. Described from specimens collected on elm.
Trialeurodes packardii (Morrill). Elm a recorded host.

COCCIDAE

Members of this family may infest the leaves, branches, or stems of elm trees. The species given below are all reported from elm.

Icerya purchasi Mask.
Gossyparia spuria (Mod.)
Eriococcus sp.
Lecaniodiaspis pruinosa Hunter.
Phenacoccus dearnessi King.
Phenacoccus insignis Lobdell.
Phenacoccus stachyos Ehrh.
Solenococcus parrotti (Hunter).
Pseudococcus maritimus (Ehrh.).
Pulvinaria vitis (L.).
Pulvinaria amygdali Ckll.
Ceroplastes cirripediformis Comst.
Coccus pseudomagnoliarium Kuw.
Lecanium caryae Fitch.
Lecanium corni Bouché.
Lecanium cerasorum Ckll.
Lecanium coryli (L.).
Lecanium excrescens Ferris.
Lecanium nigrofasciatum Perg.
Lecanium persicae (F.).
Lecanium pruinatum (Coq.).
Lecanium quercifex Fitch.
Etaerelopis boonei Holl.
Chionaspis americana Johns.
Chionaspis furfura (Fitch).
Crypthemichionaspis ulmi Hoke.
Aspidiotus ancylus Putn.
Aspidiotus camelliae Sign.
Aspidiotus diffinis Newst.
Aspidiotus forbesi Johns.
Aspidiotus howardi Ckll.
Aspidiotus juglans-regiae Comst.
Aspidiotus laianiae Sign.
Aspidiotus osborni New. and Ckll.
Aspidiotus ostreaeformis Curt.
Aspidiotus perniciosus Comst.
Aspidiotus ulmi Johns.
Pseudaonidia duplex (Ckll.).
Chrysomphalus tenebriosus (Comst.).
Lepidosaphes ulmi (L.).

COLEOPTERA

CARABIDAE

Scarites subterraneus var. *substriatus* Hald. Adult taken from dead and standing trunk.

Tachys nana (Gyll.). Adults under bark of dead elm.
Tachys flavicauda (Say). Occurs beneath bark.
Patrobis longicornis (Say). Under bark of dead elm stump.
Gynandropus hylacis (Say). In elm log.

ORTHOPERIDAE

Molamba lunata (Lec.). Reared from sections of a felled tree.
Molamba fasciata (Say). Adults reared from felled trees.

STAPHYLINIDAE

Thoracophorus costalis (Er.). Adults issued from cut elm.
Stenus suspectus Blatch. Taken beneath bark.
Erchomus ventriculus (Say). Occurs in colonies beneath bark.

Conosoma crassus (Grav.). Under moist bark.
Conosoma opicus (Say). Under moist bark.
Atheta sp. Adults emerged from branch.

HISTERIDAE

Platysoma lecontei Mars. Adults found in a copper sulfate-treated elm stump which was heavily infested with bark beetles and borers.
Platysoma parallelum (Say). Under decaying bark.
Platysoma coarctatum Lec. Adults found under the bark of elm infested with bark beetles and borers.
Cylistix gracilis (Lec.). Occurs beneath bark.
Paromalus equalis (Say). Under moist bark of dead elm.
Isomalus bistriatus (Er.). Hibernates beneath the moist bark of dead elm.
Dendrophilus punctulatus (Say). In rotten trees.
Caerosternus americanus (Lec.). Occurs beneath bark.
Acrilus exiguus (Er.). Beneath bark.
Bacanus punctiformis Lec. Beneath bark of half-decayed logs.

MALACHIIDAE

Anthocomus flavilabris (Say). Adults issued from section of a felled elm.
Pseudebaeus sp. Adults issued from section of a copper sulfate-treated tree.
Atalus sp. One specimen from a small, dry branch of a dying elm.

CLERIDAE

Thanasimus dubius (F.). Predator of *Hylurgopinus rufipes* (Eich.).
Enoclerus quadriguttatus (Oliv.). Also a predator of *Hylurgopinus rufipes* (Eich.).
Hydnocera unifasciata (Say). Adults issued from section of a felled tree.
Zenodosus sanguineus (Say). Breeds in elm.
Neichneia laticornis (Say). Adults issued from storm-damaged branch. Several adults observed feeding on *Scolytus multistriatus* (Marsh.) beetles.
Chariessa pilosa (Forst.). Trees felled a few months contained larvae of this species associated with larvae of several wood borers. Adults of *C. pilosa* prey upon *Scolytus multistriatus* beetles.
Chariessa pilosa var. *marginata* (Say). Emerged from branch 4 inches in diameter.
Orthopleura damicornis (F.). Issued from elm cut 27 months previously.

MORDELLIDAE

Tomoxia bidentata (Say). Reared from old, punky wood.
Mordella undulata Melsh. Issued from elm cut 37 months before.
Mordellistena arida Lec. Emerged from elm cut 37 months before.

PYROCHROIDAE

Schizotus cervicalis Newm. Larvae found in stumps. Adults reared from sections of felled trees.
Dendroides canadensis Latr. Larvae under moist bark of dead and decaying trees and stumps.
Dendroides concolor Newm. Emerged from elm cut 18 months earlier.

ELATERIDAE

Adlocera marmorata (F.). Beetles reared from larvae collected in decayed elm.
Alaus oculatus (L.). Larvae found in decaying logs.
Athous cucullatus (Say). Adults reared from larvae found in decayed elm.
Ludius rotundicollis (Say). Larvae in loose bark.
Parallelostethus attenuatus (Say). Larvae found in stump.
Elater manipularis Cand. Adult taken from dead standing trunk.
Elater mixtus Hbst. Under loose bark.
Elater sp. Larvae taken in bark of dead tree.
Melanotus decumanus (Er.). A single adult issued from a section of elm wood.
Melanctus communis (Gyll.). Under loose bark.

MELASIDAE

Isorhipis ruficornis (Say). From dead elm.

BUPRESTIDAE

Chalcophorella campestris (Say). One adult reared from a branch.

Dicerca divaricata (Say). Reared from dead branches and small standing dead trees.

Poecilnота cyanipes (Say). Breeds in elm.

Buprestis rufipes (Oliv.). Adults were observed ovipositing in weathered snags without bark. Breeds in dead elm.

Anthaxia viridifrons Gory. Reared from small branches of weakened or dead trees.

Chrysobothris mali Horn. Larvae mine normal, injured, dying, and dead trees.

Chrysobothris femorata auct. Larval habits similar to those of *C. mali*. Sometimes the adults destroy the buds and defoliate elms by cutting off the petioles of the leaves.

Chrysobothris purpureovittata Horn. Bred from elm twigs.

Agrilus arcuatus (Say). Elm a recorded host.

Agrilus audax Horn. Bred from branches 4 inches in diameter.

Brachys aerosus Melsh. Eats irregular, oval holes near edges of leaves.

Brachys aerosus var. *rufescens* N. and W. Adults feed extensively on the leaves, cutting irregular holes.

Brachys aeruginosus Gory. Mines the leaves.

RHYSODIDAE

Rhysodes americanus Lap. Hibernates singly or in small colonies beneath the bark of logs.

OSTOMIDAE

Airora cylindrica (Serv.). Larvae make irregular galleries in wood of decayed trees. Adults are found under bark.

Temnochila virescens (F.). Taken from cell in broken-down treetop.

Tenebroides sinuatus (Lec.). Adults taken from dead standing trunk.

Tenebroides bimaculatus (Melsh.). Larvae and adults found under bark.

Tenebroides americanus (Kby.). Adults taken from dead standing trunk.

Tenebroides corticalis (Melsh.). In both freshly cut and well-decayed material. Adults and probably larvae are predators of wood-boring insects.

NITIDULIDAE

Epuraea sp. Adult issued from elm cut 26 months earlier.

Amphicrossus ciliatus (Oliv.). Breeds in elm.

Cryptarcha ampla Er. Breeds in elm.

Glischrochilus fasciatus (Oliv.). Breeds in elm.

Glischrochilus sanguinolentus (Oliv.). Breeds in elm.

CUCUJIDAE

Silvanus bidentatus (F.) Under moist bark of a dead tree.

Silvanus imbellis Lec. Under bark of log.

Catogenus rufus (F.) Reared. Beetles have been taken under dead bark.

Cucujus clavipes (F.) Adults and larvae found under bark of dead and dying trees.

Laemophloeus fasciatus Melsh. Reared from felled trees. Adults found under bark.

Laemophloeus liquidus Csy. Under decaying bark. Sometimes found in tunnels of bark beetles in recently killed wood.

Dendrophagus cygnaei Mann. Occurs under bark.

Uleiota dubia F. Beetles occur under dead bark. Adults taken from dead and standing trunk.

EROTYLIDAE

Hypodacne punctata Lec. Gregarious beneath bark.

Megalodacne fasciata (F.) Adults found under bark.

MYCETOPHAGIDAE

Mycetophagus sp. Larvae found in bark.
Litargus balteatus Lec. Reared from sections of trees.

COLYDIIDAE

Synchita fuliginosa Melsh. Larvae in old loose bark. Adults reared from logs.
Eucicones marginalis (Melsh.). Reared from log.
Aulonium parallelopipedum (Say). Under bark.
Colydium lineola Say. Adult taken in a gallery containing adults of *Xyloterinus politus* Say deep in wood of a dying elm tree.
Bothrideres geminatus (Say). Under bark.
Erotylathris exaratus (Melsh.). Beneath bark of dead elm.
Cerylon castaneum Say. Beneath bark.

ENDOMYCHIDAE

Rhymbus sp. Emerged from elm cut 15 months previously.

TENEBRIONIDAE

Diaperis maculata Oliv. Gregarious beneath bark of dead trees.
Hoplocephala bicornis (F.). Under bark.
Platydemus excavatum (Say). Under bark.
Platydemus ruficornis (Sturm). Under bark.
Tribolium castaneum (Hbst.). Probably acts as a scavenger. Unable to subsist entirely on elm.
Tribolium confusum J. du V. Probably acts as a scavenger. Unable to subsist entirely on elm.
Doliema pallida (Say). Under bark.
Merinus laevis (Oliv.). Larvae found in elm.
Xylopinus aenescens Lec. Reared from dead elm.
Xylopinus saperdoides (Oliv.). Reared from logs and sections of dead trees.
Alobates pennsylvanica (Deg.). Adults found under bark of dead branches and trees. Larvae found in similar situations and in well-decayed wood.
Upis ceramoides (L.). Adults under loose bark.
Idiobates castaneus (Knoch). Reared.
Tenebrio tenebrioides Beauv. Under bark.
Strongylium tenuicolle Say. Reared from log.

MELANDRYIDAE

Synchroa punctata Newm. Reared from decayed elm material.
Canifa pallipes (Melsh.). Reared from sections of felled trees.

ANOBIIDAE

Vrilletta ? expansa Lec. Breeds in dead branches.
Hadrobregmus carinatus (Say). Breeds in elm.
Catorama nigratulum (Lec.). Adults reared from larvae taken in outer wood of a debarked stump about a year old.
Ptilinus ruficornis Say. Reared from dead branches. Adults bore in barked wood.

BOSTRICHIDAE

Endecatomus reticulatus (Hbst.). Breeds in elm.
Scobicia bidentata (Horn). In freshly cut wood.
Xylobiops basilaris (Say). Adults seem to prefer broken, recently cut, or dying branches ½ to 2 inches in diameter for breeding purposes.
Amphicerus bicaudatus (Say). Found in dead branches and stems.
Lichenophanes bicornis (Web.). Reared from branches.
Lichenophanes armiger (Lec.). Breeds in elm.
Polycaon confertus Lec. Twigs of young elm trees pruned by this species.

CISIDAE

Cis setulosus Mell. Adults found in dead elm.
Cis sp. Adults taken from bark of dead branches.

SCARABAEIDAE

Unless otherwise noted, adults of the species listed under this family feed on the foliage of elm.

Phyllophaga praetermissa (Horn).
Phyllophaga forbesi Glasgow.
Phyllophaga futilis (Lec.).
Phyllophaga hirtiventris (Horn).
Phyllophaga congrua (Lec.).
Phyllophaga calceata (Lec.).
Phyllophaga crassissima (Blanch.).
Phyllophaga inversa (Horn).
Phyllophaga bipartita (Horn).
Phyllophaga micans (Knoch).
Phyllophaga fusca (Fröl.).
Phyllophaga ulkei (Sm.).
Phyllophaga horni (Sm.).
Phyllophaga anxia (Lec.).
Phyllophaga drakii (Kby.).
Phyllophaga fraterna var. *mississippiensis* Davis.
Phyllophaga luctuosa (Horn).
Phyllophaga corrossa (Lec.).
Phyllophaga profunda (Blanch.).
Phyllophaga rugosa (Melsh.).
Phyllophaga implicita (Horn).
Phyllophaga hirticula (Knoch).
Phyllophaga hirticula var. *comosa* Davis.
Phyllophaga ilicis (Knoch).
Phyllophaga crenulata (Fröl.).
Phyllophaga rubiginosa (Lec.).
Phyllophaga tristis (F.).
Phyllophaga pearliae Davis.
Phyllophaga perlonga Davis.
Macrodactylus subspinosus (F.).
Popillia japonica Newm.
Pelidnota punctata (L.). Grubs of this species develop in decayed logs and stumps.
Ligyris gibbosus (Deg.).
Osmoderma eremicola (Knoch). Larvae develop in decayed wood.
Trichiotinus affinis (G. and P.). Larvae occur in wood of fallen decayed branches.

LUCANIDAE

Ceruchus piceus (Web.). Larvae develop in decayed logs.

PASSALIDAE

Popilius disjunctus (Illig.). Adults observed in a stump.

CERAMBYCIDAE

Parandra brunnea (F.). Reared from elm.
Derobrachus sp. Larva taken from stump.
Distenia undata (F.). Larvae found in mines beneath bark.
Smodicum cucujiforme (Say). Larva in heartwood of very old, dry, and seasoned material. Adults found under bark of dead trees.
Dryobius sexfasciatus (Say). Larvae mine inner bark of dead elm.
Tylonotus bimaculatus Hald. Reared.
Eburia quadrigeminata (Say). Adults found under loose bark of dead tree.
Hypermallus villosus (F.). Larvae bore in small branches 1 inch or less in diameter and cause them to drop off trees.

- Elaphidion mucronatum* (Say). Adults reared from branch 4 inches in diameter.
Anoplodera pubera (Say). Reared from branches.
Anoplodera minnesotana (Csy.). Reared from decayed logs.
Strangalia luteicornis (F.). Larvae taken in decaying branches.
Leptura emarginata L. Reared from decayed logs.
Leptura mutabilis Newm. Breeds in elm.
Physocnemum brevilineum (Say). Reared from felled trees and logs. Larvae commonly mine outer bark of living elms but seldom penetrate to cambium.
Xylotrechus colonus (F.). Larvae mine in sapwood of dead and dying material.
Xylotrechus nauticus (Mann.). Adults and larvae reported from elm.
Neoclytus caprea (Say). Reared from limbs and trunks. Larvae mine in sapwood of weakened trees.
Neoclytus mucronatus (F.). Reared from elm logs cut from devitalized trees.
Neoclytus acuminatus (F.). Larvae mine between bark and wood of cut and weakened trees.
Eudermes picipes (F.). Reared.
Stenosphenus notatus (Oliv.). Adults under loose bark.
Psenocerus supernotatus (Say). Larvae taken in elm.
Synaphaeta guezi (Lec.). Adult in cell of outer wood of limb.
Hammoderus tessellata (Hald.). Larvae of this and the next three species bore deeply into the wood, causing large, unsightly defects.
Goes tigrinus (Deg.).
Goes pulcher (Hald.).
Goes pulverulentus (Hald.). Larvae excavate large mines deep in heartwood of apparently healthy elm branches ranging from 1 to 4 inches in diameter.
Acanthoderes modesta (Gyll.). Reared from decayed branches and old felled trees.
Psapharochrus quadrigibbus (Say). Larvae taken from decaying elm branch.
Leptostylus tuberculatus Fröl. Larvae found under bark of weakened branches and trees.
Astylopsis macula (Say). Reared from logs and felled trees.
Leiopus variegatus (Hald.). Emerged from elm cut 25 months previously.
Leiopus alpha (Say). Larvae collected in felled trees cut less than a year.
Lepturges symmetricus (Hald.). Reared from dead elm branches.
Lepturges quercus Fitch. Reared from old felled trees.
Hyperplatys asperatus (Say). Reared from branches and felled trees.
Graphisurus fasciatus (Deg.). Reared from logs.
Eupogonius vestitus (Say). Larvae occur in elm.
Eupogonius subarmatus (Lec.). Breeds in elm.
Oncideres cingulatus (Say). Female cuts off twigs one-half inch or less in diameter and deposits eggs above the girdle.
Saperda tridentata Oliv. Larvae work in inner bark and sapwood of devitalized elm and, if abundant, girdle branches and trunk and cause death of tree.
Saperda lateralis F. Larvae mine inner bark of logs and dead trees.
Oberea tripunctata (Swed.). Adults feed on leaf veins and young twigs. Female cuts a groove around twig near tip so that sooner or later the twig breaks off. A second groove is cut a few inches below first, and the egg is deposited in an incision made between the grooves. Larvae bore in small twigs.
Oberea ulmicola Chitt. Habits similar to those given for *O. tripunctata*.

CHRYSEMELIDAE

Unless otherwise noted, species listed under this family are leaf feeders.

- Nodonota tristis* (Oliv.). Adults found in cells in broken-down treetops.
Nodonota puncticollis (Say).
Xanthonia decemnotata (Say).
Calligrapha scalaris (Lec.).
Monocesta coryli (Say).
Galerucella xanthomelaena (Schrank).
Disonychia uniguttata (Say). Adults taken under elm bark.
Altica chalybea Ill.
Altica ignita Ill. Hibernates under rough bark.
Altica ulmi Woods. Larvae and adults feed on leaves. Adults hibernate under loose bark.
Altica carinata Germ.
Chalepus dorsalis Thunb.

BRENTIDAE

Arrhenodes minutus (Dru.). Larvae excavate galleries in the solid wood of weakened trees.

ANTHRIBIDAE

Eusphyrus walshii Lec. Issued from felled trees.

Euparius marmoreus (Oliv.). Breeds in elm.

CURCULIONIDAE

Phyllobius oblongus (L.). A European weevil that feeds on elm leaves in this country.

Ploceus ulmi Lec. Breeds in elm.

Magdalis barbicornis (Latr.). A European species reared from elm in this country.

Magdalis pandura (Say). Reared.

Magdalis inconspicua Horn. Larvae of this species and the two following species occur under bark of dying or recently dead elm branches and trees.

Magdalis barbata (Say). Adults of this and the next species feed on intervenal tissue of elm leaves, usually skeletonizing and often consuming entire portions of them.

Magdalis armicollis (Say).

Rhynchaenus pallicornis (Say). Mines the leaves.

Gymnetron antirrhini (Payk.). Under bark.

Gelus oculatus (Say). Reared.

Acoptus suturalis Lec. Reared from branch.

Ccnotrachelus affinis Boh. Breeds in elm.

Sternochetus fuscatus (Lec.). Breeds in elm.

Sternochetus obtentus (Hbst.). Reared from branches.

Sternochetus fallax (Lec.). Adults reared from an old log found on ground.

Sternochetus sp. Larvae taken in crotches of branches of dying trees.

Tyloderma foveolata Say. Leaf feeder.

Acamptus rigidus Lec. Emerged from elm wood.

Himatium errans Lec. Under bark of dead elm.

Cossonus platalea Say. Beneath bark.

Cossonus impressus Boh. Under bark of dead elm.

Phloeophagus minor Horn. Occurs in decayed trunks.

Pentarthrinus parvicollis Csy. Found in a dead stub.

Stenoscelis brevis (Boh.). Found in solid and dry wood of trunks.

SCOLYTIDAE

Platypus compositus Say. Reared. Adults enter green sapwood and heartwood.

Scolytus quadrispinosus Say. Reared from dead branch.

Scolytus muticus Say. Adult observed boring in a twig.

Scolytus rugulosus (Ratz.). Breeds in cut branches and in sickly or dying trees. One adult observed feeding in an elm twig crotch.

Scolytus multistriatus (Marsh.). Makes brood burrows in cut or weakened and dying branches or trunks. Adults feed in twig crotches of healthy elm trees.

Scolytus sulcatus Lec. Makes brood burrows in cut or weakened and dying branches or trunks. Adults feed in twig crotches of healthy elms.

Hylurgopinus rufipes (Eich.). Breeds in cut or weakened and dying branches or trunks.

Micracis suturalis Lec. Elm a recorded host.

Micracis opacicollis Lec. Adults found excavating gallery in small twig.

Micracis sp. Brood burrows containing larvae and adults found in dead limbs.

Thysanoes berchemiae Blkm. Elm reported as host.

Hylocurus biorbis (Blkm.). Adult issued from a dead branch.

Hylocurus langstoni (Blkm.). Adults removed from brood burrows made in elm wood.

Pterocyclon fasciatum (Say). Reared.

Pterocyclon mali (Fitch). Reared from logs, dead trees, and roots of old stumps.

Corthylus columbianus Hopk. This ambrosia beetle bores in living sapwood of elm.

Xyloterinus politus (Say). Adults attack green wood of logs, stumps, dying trees, and wounded places on green trees.

Hypothenemus punctifrons Hopk. Breeds in elm.

Stephanoderes quadridentatus Hopk. One adult removed from a branch 3 inches in diameter.

Stephanoderes dissimilis (Zimm.). Found boring in recently cut tree.

Stephanoderes sp. Adults obtained from brood burrows made in bark and wood of dead branch.

Pityophthorus rhois Sw. Breeds in dead and dying branches.

Anisandrus dispar (F.). This European species makes brood burrows in unhealthy or dying elm trees in this country.

Anisandrus minor Sw. Attacks freshly cut wood.

Xyleborus saeseni (Ratz.). This introduced European ambrosia beetle has been reared from logs, dead and dying trees, and old stumps.

Xyleborus affinis Eich. Breeds in same material as *X. saeseni*.

Xyleborus fuscatus Eich. Reared.

Xylosandrus germanus (Bldfd.). Introduced oriental species observed to attack and sometimes reproduce in recently felled, dead, and fire-scarred trees, as well as in freshly cut and old logs and stumps.

LEPIDOPTERA

Those species unaccompanied by notes and listed under this order are leaf feeders in the larval stage.

INCURVARIIDAE

Paraclemensia acerifoliella (Fitch).

NEPTICULIDAE

Nepticula apicalbela Cham. Makes a brown serpentine mine on upper side of leaf.

Nepticula ulmella Braun. Mines in leaves.

MEGALOPYGIDAE

Megalopyge opercularis (A. and S.).

Megalopyge crispata (Pack.).

LIMACODIDAE

Sibine stimulea (Clem.).

Parasa chloris (H.-S.).

Sisyrosea textula (H.-S.).

Prolimacodes badia (Hbn.).

TINEIDAE

Tinea defectella Zell. One adult issued from elm cut 15 months previously.

Xylestha pruniramiella Clem. Adult issued from elm cut 15 months before.

Oenoe hybromella Cham. Emerged from section of tree felled 40 months previously.

PSYCHIDAE

Thyridopteryx ephemeraeformis (Haw.).

LYONETHIDAE

Bucculatrix sp.

GRACILARIIDAE

Marmara elotella (Busck).

Phyllonorycter argentinotella (Clem.). Larva usually makes a tentiform mine in under sides of leaves.

Phyllonorycter occitanica (F. and B.). Mines under sides of leaves.

Cameraria ulmella (Cham.). Larva makes a flat mine in upper side of leaf.

COLEOPHORIDAE

Coleophora limosipennella (Dup.). Larvae of the elm case bearer mine between the principal veins of the leaf and consequently the brownish blotches are more or less rectangular in shape.

OECOPHORIDAE

Schiffermuelleria argenticinctella (Clem.). Emerged from sections of trees felled 15 and 39 months before.

GELECHIIDAE

Helice constrictella (Zell.). Larva makes a web on under side of leaf, connected by a whitish tube of silk and frass to base of petiole.

COSMOPTERYGIDAE

Perimede erransella Cham. Reared from branches.

YPONOMEUTIDAE

Argyresthia undulatella Cham. Larva a bast miner on trunks and larger branches.

SCYTHRIDIDAE

Scythris impositella (Zell.). Issued from elm cut 14 months previously.

OLETHREUTIDAE

Anchylopera fuscociliana Clem.

Episimus argutanus (Clem.).

TORTRICIDAE

Argyrotaenia velutinana (Walk.).

Archips argyrospila Walk. Leaf roller.

Archips rosaceana Harr. Leaf roller

COSSIDAE

Prionoxystus robiniae (Peck). Older larvae make large burrows, up to one-half inch in diameter, in heartwood of branches and trunks, causing serious deformities.

Zeuzera pyrina (L.). Pest of healthy, vigorous trees. Young caterpillars usually enter the twigs at the base of a bud, and after feeding for a time leave their burrows and enter larger branches, where they excavate large, irregular burrows.

EPIPASCHIIDAE

Tetralopha asperatella (Clem.).

PHYCITIDAE

Canarsia ulmiarrosorella (Clem.). Larvae are found in a silk nest between leaves on which they feed. Pupates in bark on trunks and larger limbs.

Hulstia undulatella (Clem.).

CITHERONIIDAE

Basilona imperialis (Dru.).

Anisota rubicunda (F.).

SATURNIIDAE

Automeris io (F.).

Telea polyphemus (Cram.).

Samia cecropia (L.).

LASIOCAMPIDAE

Tolyte velleda (Stoll).
Malacosoma dissiria Hbn.

DREPANIDAE

Drepana bilineata (Pack.).

GEOMETRIDAE

Alsophila pometaria (Harr.).
Lygris diversilineata (Hbn.).
Oporinia autumnata (Guen.).
Hydrelia albifera (Walk.).
Paraphia unipunctata (Haw.).
Pseudoboarmia umbrosaria (Hbn.).
Ectropis crepuscularia (Schiff.).
Lycia ursaria (Walk.).
Amphidasis cognataria Guen.
Phigalia tilea (Cram.).
Paleacrita vernata (Peck).
Erannis tiliaria (Harr.).
Ellopija fiscellaria Guen.
Campaea perlata (Guen.).
Ennomos subsignarius (Hbn.).
Deuteronomos magnarius (Guen.).
Ellopija quercivoraria (Guen.).
Sabulodes caberata Guen.
Abbottana clemataria (A. and S.).

SPHINGIDAE

Ceratomia amyntor (Hbn.).
Smerinthus jamaicensis (Dru.).
Smerinthus jamaicensis Dru. f. norm. *geminatus* (Say).
Paonias excaecatus (A. and S.).
Celerio lineata (F.).

NOTODONTIDAE

Melalopha inclusa (Hbn.).
Datana ministra (Dru.).
Datana contracta Walk.
Nerice bidentata Walk.
Symmerista albifrons (A. and S.).
Heterocampa manteo (Dblly.).
Heterocampa guttinitta (Walk.).
Heterocampa bilineata (Pack.).
Schizura ipomoeae Dbldy.
Schizura concinna (A. and S.).
Schizura unicornis (A. and S.).
Gluphisia septentrionis Walk.

LIPARIDAE

Hemerocampa leucostigma (A. and S.). Besides feeding on the leaves, the larvae sometimes girdle most of the terminal growth of the season.
Hemerocampa inornata Beut.
Olene basiflava Pack.
Olene cinnamomea (G. and R.).
Porthetria dispar (L.).
Nygmia phaeorhoca (Don.).

PHALAENIDAE

Bomolocha abalinalis (Walk.).
Safia amella (Guen.). Reared from specimens chopped out of chambers found in elm.
Charadra deridens (Guen.).

Marathyssa basalis (Walk.).
Acrionicta rubricoma Guen.
Acrionicta americana Harr.
Acrionicta morula G. and R.
Acrionicta interrupta Guen.
Acrionicta funeralis G. and R.
Acrionicta vinnula (Grt.).
Acrionicta grisea Walk.
Acrionicta impleta Walk.
Acrionicta impleta Walk. var. *krautwurmi* Chermock.
Acrionicta oblinita (A. and S.).
Conistra morrisoni (Grt.).
Eumichtis versuta (Sm.).
Agrotis fennica (Tausch.).

ARCTIIDAE

Utetheisa bella (L.).
Hyphantria cunea (Dru.).
Halisidota tessellaris (A. and S.).
Halisidota maculata (Harr.).
Halisidota caryae (Harr.).

NYMPHALIDAE

Polygonia comma (Harr.).
Polygonia interrogationis (F.).
Polygonia progne (Cram.).
Aglais antiopa (L.).
Vanessa atalanta (L.).
Basilarchia arthemis (Dru.).

DIPTERA

ANISOPODIDAE

Mycetobia divergens Walk. Larvae found under bark and in wounds on trees.

TIPULIDAE

Epiphragma fascipennis (Say). Immature stages in decaying or partly sound wood.

Ctenophora apicata O. S. Larvae and pupae found in an elm stump.

Tipula penobscot Alex. Reared from trunk of dead elm.

Tanyptera sp. Larvae collected deep in wood of standing dead tree.

PSYCHODIDAE

Psychoda sp. Issued from elm cut a year previously.

CERATOPOGONIDAE

Dasyhelea sp. Larvae and pupae collected from wound on trunk of elm tree.

CECIDOMYIIDAE

Oligarces ulmi Felt. Reared from larvae under decaying bark.

Asynapta sp. Reared from branches.

Holoneurus sp. Issued from elm cut 7 months before.

Dasyneura ulmea Felt. Causes aborted or blasted buds.

Phytophaga ulmi Beut. Galls on small developing leaves.

MYCETOPHILIDAE

Leia bivittata Say. Reared from felled trees and old elm roots.

SCIARIDAE

Sciara coprophila Lint. Emerged from sections of trees felled 7 to 12 months previously.

Sciara fenestralis Zett. Breeds in elm.

RHACIONIDAE

Xylophagus lugens Loew. Larvae found under bark of dead elm. Predacious on wood-boring larvae.

STRATIOMYIIDAE

Geosargus sp. Larvae found in flowing sap of elm tree.
Neopachygaster maculicornis Hine. Larvae feed on decaying matter under slightly loosened bark. Observed also to feed upon larvae of *Lonchaea polita* Say.
Eupachygaster henshawi Mall. Adults issued from larvae found under bark of felled trees.
Zabrachia polita Coq. Reared from decaying elm.

ASILIDAE

Laphriinae. One larva of undetermined genus and species of this subfamily found in elm branch.
Laphria sp. Pupal cases of this fly found projecting from a dead area in a living tree.

DOLICHOPODIDAE

Medetera ciliata Van D. Reared from elm material usually infested with *Scolytus multistriatus* (Marsh.).
Dolichopus ramifer Loew. One adult reared from elm bark.

PHORIDAE

Megaselia scalaris (Loew). One adult reared from elm.

SYRPHIDAE

Eristalis sp. Larva taken in elm tree.

ANTHOMYIIDAE

Larvae found under bark along edges of wounds.

LONCHAEIDAE

Lonchaea polita Say. Reared from elm logs infested with bark beetles and borers.

OTITIDAE

Euxesta, n. sp. Reared from elm. Sometimes this species feeds on sap.
Pseudotephritis vau (Say). Pupates in bark.

CHLOROPIDAE

Gaurax apicalis Mall. Reared from moist bark.
Gaurax montanus Coq. Reared from moist bark.
Oscinella trigramma Loew. Reared from elm trees cut 1 year before.

DROSOPHILIDAE

Drosophila sp. Pupae obtained from elm.

AGROMYZIDAE

Odinia maculata Meig. Reared from logs.
Agromyza ulmi Frost. Mines in leaves.

HYMENOPTERA

XYELIDAE

Macroxycla ferruginea (Say). Adults eat out the buds
Macroxycla infuscata (Nort.). Larvae feed on the leaves.

XIPHYDRIIDAE

Xiphydria hickoriae Roh. Makes galleries deep in wood of dead and dying trees.
Xiphydria tibialis Say. Makes galleries deep in the wood of dead and dying elm.

SIRICIDAE

Tremex columba L. Larvae of this large wood wasp usually confine their work to weakened or dying trees and bore deep into the wood.

CIMBICIDAE

Cimbex americana Leach. Defoliator.

ARGIDAE

Arge calcanea Say. Leaf feeder.
Arge scapularis Klug. Leaf feeder.

TENTHREDINIDAE

Strongylogastroidea uncinata (Nort.). One adult issued from a log.
Macremphytus intermedius (Dyar). One adult issued from elm cut 27 months previously.
Fenusa dohrnii (Tischb.). Larva mines in leaves.
Kaliopenusa ulmi (Sund.). Larvae of this introduced sawfly make irregular blotched mines in leaves.
Empria maculata (Nort.). Reared from bark.
Strongylogaster politus Cress. Two adults reared from elm.

BRACONIDAE

Capitonus erythrogaster (Roh.). One adult reared.
Capitonus saperdae (Ashm.). Parasite of *Saperda tridentata* Oliv. larvae.
Atanycolus ulmicola (Vier.). Parasite of *Saperda tridentata* larvae.
Atanycolus simplex (Cress.). Adult observed ovipositing in bark of elm log infested with cerambycid larvae.
Ceoloides sp. Specimens issued from elm infested with *Magdalis armicollis* Say.
Monogonogastra agrili (Ashm.). Reared from branches and logs.
Monogonogastra eurygaster Brullé. Issued from a cerambycid larva found under bark of dying elm.
Microbracon, n. sp. Adults issued from elm cut about 1 year previously.
Spathius canadensis Ashm. This species is parasitic on the larvae of *Scolytus multistriatus* (Marsh.), *Hylurgopinus rufipes* (Eich.), *Magdalis armicollis* Say, and *M. barbata* Say.
Spathius similimus Ashm. Adults issued from branches.
Doryctes sp. Adults issued from elm cut about 1 year before.
Ecphyllus sp. Adults obtained from elm infested with *Magdalis armicollis* Say.
Heterospilus anthaxiae (Ashm.). Reared from logs.
Heterospilus, n. sp. Parasite of *Saperda tridentata* Oliv. larvae.
Triaspis curculionis (Fitch). Reared from branches.
Triaspis, n. sp. Reared from elm cut 16 to 38 months previously.
Chilonus sp. Adults reared from elm.
Ascogaster sp. One adult issued from felled tree.
Apanteles sp. Reared from branch.
Eubadizon magdali (Cress.). A parasite of larvae of *Scolytus multistriatus* (Marsh.), *Magdalis armicollis* Say, and *M. barbata* Say.
Eubadizon sp. Reared from elm.
Brachistes rotundiceps Cress. Reared from sections of dead and dying elm.
Helconidea albitalarsis (Cress.). Reared.
Helconidea ligator (Say). Reared.
Synaldis sp. One individual reared from elm.

ICHNEUMONIDAE

- Chaeretymma* sp. One individual found dead in larval tunnel of *Dicercia divaricata* (Say) in elm.
Chaeretymma sp. Reared.
Phaeogenes mellinus Prov. Taken in dead elm.
Lissonota sp. Adults issued from felled tree.
Asphragis sp. Reared.
Theronia fulvescens (Cress.). One individual reared from elm.
Grotea anguina Cress. One individual reared from elm.
Rhyssella humida (Say). One adult issued from branch infested with *Xiphydria tibialis* Say.
Rhyssella nitida (Cress.). Parasite of *Xiphydria* sp.
Megarhyssa atrata (F.). Parasite of *Tremex columba* L. larvae.
Megarhyssa lunator (F.). Parasite of *Tremex columba* larvae.
Arotes decorus (Say). Reared.
Xorides albopictus (Cress.). Parasitic on larvae of *Saperda tridentata* Oliv.
Xorides calidus Prov. Reared.
Xorides humeralis (Say). Reared from dead trees.
Deuteroxorides caryae (Harr.). Apparently a parasite of *Saperda tridentata* Oliv. larvae.
Odontomerus vicinus Cress. Parasite of *Dicercia divaricata* (Say).
Ichneumon irritator F. Emerged from elm cut about 27 months previously.
Ichneumon, n. sp. Observed ovipositing in same trees as *I. irritator*.
Triclistus curvator (F.). One adult issued from felled tree.
Trichomma reticulatum Davis. One individual reared from elm.
Cremastus sp. One adult issued from felled tree.

CYNIPIDAE

- Ibalia maculipennis* Hald. Observed ovipositing in elm infested with borers.

CHALCIDIDAE

- Phasgonophora sulcata* Westw. Adults issued from bark of dying tree.
Phasgonophora sp. Reared from an elm branch infested with *Chrysobothris femorata* (Oliv.) and *Neoclytus acuminatus* (F.).
Haltichella sp. Reared from broken-down elm treetop.
Trigonura hicoloriae Roh. Adults reared from elm infested with *Magdalis barbata* Say and *M. armicollis* Say.
Trigonura tarsata (D. T.). Specimens reared from cut elm and weakened trees.
Trigonura, n. sp. Apparently parasitic on *Magdalis barbata* Say and *M. armicollis* Say.
Trigonoderus algonquinia Gir. One adult issued from elm.
Trigonoderus sp. One adult issued from elm.

EURYTOMIDAE

- Eurytoma abnorme* Ashm. Reared from dead trees.
Eurytoma appendigaster (Swed.). One adult emerged from elm cut 14 months previously.
Eurytoma magdalidis Ashm. Parasite of *Magdalis armicollis* Say.
Prodecatoma, n. sp. Reared.

ENCYRTIDAE

- Eupelmus cyaniceps* var. *amicus* Gir. Parasitic on larvae of *Scolytus multistriatus* (Marsh.).
Eupelmus juglandis Ashm. Reared from elm infested with *Magdalis* spp.

CLEONYMIDAE

- Cheiropachus colon* (L.). Parasitic on larvae of *Scolytus multistriatus* (Marsh.).

PTEROMALIDAE

Dibrachys sp. Emerged from elm material infested with *Magdalis armicollis* Say and *M. barbata* Say.

Amblymerus sp. One adult emerged from a *Hylurgopinus rufipes* (Eich.) adult found in its hibernating gallery in bark of living tree.

Rhaphitelus maculatus Walk. Adults emerged from elm sticks infested with *Magdalis armicollis* Say and *M. barbata* Say.

EULOPHIDAE

Cirrospilus flavicinctus Riley. One adult issued from felled tree.

Entedon leucogramma (Ratz.). Introduced European species parasitic on *Scolytus multistriatus* (Marsh.).

MYMARIDAE

Polynema sp. Adults emerged from elm felled about 1 year before.

CHRYSIDIDAE

Omalus corruscans (Nort.). One individual reared from elm.

FORMICIDAE

Crematogaster laeviuscula Mayr. Females and workers removed from dead standing trunk.

Leptothorax schauumi Roger. Nests in bark of large elms.

Camponotus herculeanus (L.) subsp. or var. Honeycombs interior of weakened trees.

Camponotus herculeanus (L.) subsp. *pennsylvanicus* (Deg.). Makes tunnels in solid wood of dead and dying trees.

Camponotus nearcticus Emery. Colony found in dead elm stub.

SPHECIDAE

Stigmus conestogorum Roh. Reared.

Trypoxylon frigidum Sm. Reared.

Pemphredon concolor Prov. Taken from a dead standing trunk.

Solenius producticollis Pack. One individual from a log.

HALICTIDAE

Halictus caeruleus Robt. One individual found in elm.

Halictus macropinensis Robt. One adult issued from dead stump.

Augochlora pura (Say). One individual found under bark of stump.

MEGACHILIDAE

Megachile sp. A nest of this bee found in a dead elm.



11